ENGINEERING OUTLOOK

AT THE UNIVERSITY OF ILLINOIS

RESEARCH
EDUCATION
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ALUMNI JOIN IN REACTOR DEDICATION

On October 21 the University officially dedicated the new TRIGA MARK II nuclear reactor. Members of the Engineering Alumni Committee, on campus for their annual meeting, also attended the dedication for a look at one of the latest educational and research tools at the University. After the dedication ceremonies, Atomic Energy Commission officials and other distinguished guests were invited to attend the Alumni Committee meetings taking place on the evening of the 21st and throughout the following morning.

The reactor, the first above-ground type in the United States to use uranium-zirconium-hydride fuel elements, was open to inspection throughout both days. Alumni Committee members and the guests attending the reactor dedication toured the reactor facilities. Guides described the reactor's place in the Engineering Experiment Station's research program and in the College's graduate degree program in Nuclear Engineering.

The Alumni Committee was formed in 1952 to serve as a liaison between the College and Illinois high schools. The committee, made up of graduates of the U. of I. College of Engineering, has grown from its original 41 to 137 members, serving high schools in many regions of Illinois and adjoining states. The men are all situated in industry or in private consulting practice.

The Engineering Alumni Committee is not a student recruiting agency, but rather a group which informs high school students of the opportunities of an engineering career. The men serve as a source of authority for the field of engineering and are often called upon by high school principals to speak to the students during Career Day programs. Upon request the men also counsel students individually.

The committee is directed by an advisory board of seven men: Frank H. Beinhauer, chairman, Decatur; Dean C. Broughton, Milwaukee; Ralph E. Campbell, Crystal Lake; Charles A. Davis, Moline; F. M. Rich, East Chicago, Indiana; J. G. Ryan, Wood River; and Thomas D. Wofford, Chicago.

Information and aid are supplied to this committee through W. L. Everitt, Dean of the College of Engineering. Requests for further information about this committee may be addressed to Dean Everitt, 106 Civil Engineering Hall, Urbana, Illinois.

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U. OF I. PROFESSORS IN INTERNATIONAL ELITE

The basic nature of much of the research program in the College of Engineering was strikingly illustrated recently by invitations to two engineering professors to the Symposium on Basic Sciences in France and the United States, held in October in New York City. Dr. Ven Te Chow of Civil Engineering and Dr. James M. Robertson of Theoretical and Applied Mechanics participated in the Symposium of 100 leading scientists from universities, governments, and industrial laboratories in France and the United States.

The Symposium was sponsored by the Sloan Foundation and the French Government to provide an exchange of ideas among scientists from several fields.

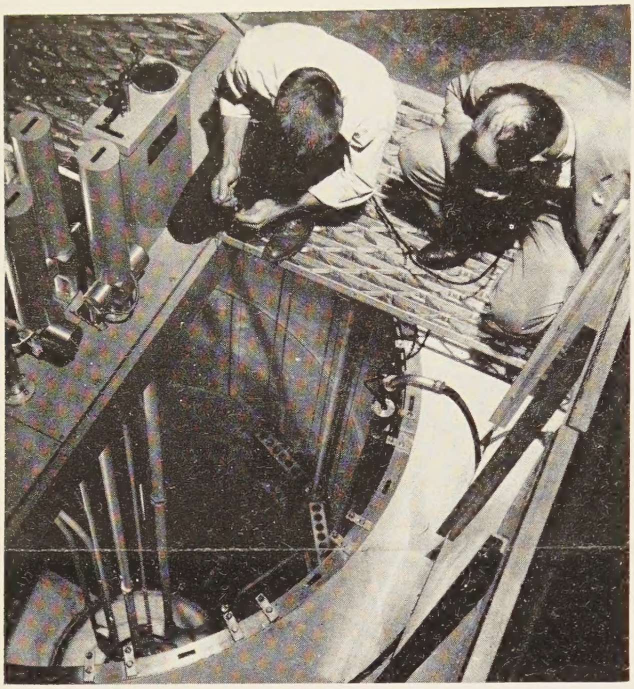
Dr. Chow is conducting research currently in hydrology and hydromechanics. Some of his projects include tornado studies, highway drainage problems, surface runoff factors, and the theory of gradually varied flow.

Dr. Robertson, conducting research in fluid mechanics, is concerned currently with the behavior of bodies passing from water to air as in the case of underwater launching of missiles. Also he is studying the turbulent boundary layer theory in regard to lubricant flow phenomena.

The Alfred P. Sloan Foundation, co-sponsor of the Symposium, includes among its purposes the support of research and education in the physical sciences. The foundation also maintains an extensive undergraduate scholarship program.

QUALITY CONTROL IN ENGINEERING EDUCATION

Much has been said recently about the need for greater numbers of trained engineers, but the drive for quantity has not made educators at the University of Illinois lose sight of the need for quality. One phase of the College



The radioactive core of the College of Engineering's new Illinois TRIGA MARK II nuclear reactor is visible from above through 16 feet of demineralized water. Reactor Supervisor Gerald Beck (left) and Professor D. F. Hang are shown here checking radiation detection devices. Control rods can be seen extending from the left downward into the core. The Nuclear Reactor Laboratory was dedicated on October 21 in ceremonies and symposia held throughout the day on the Urbana campus. The dedication was held in conjunction with the annual meeting of the College's Engineering Alumni Committee.

of Engineering's effort to get the highest quality is its Honors Program.

Of 5080 entering freshmen this fall on the Urbana campus, 192 were in the Edmund J. James Scholar Program, and of these, 34 are in the College of Engineering. Electrical Engineering leads with 11 students and Engineering Physics is second with 8. The remaining students are well distributed through 6 other departments in the College, with 3 still unspecified as to field of engineering. There are 301 students in the James Scholar Program at all levels, of which 46 are in Engineering.

The James Scholar Program was initiated by the University in September, 1959, to recognize and encourage outstanding scholarship. The Program operates in conjunction with undergraduate honors programs in the various colleges and schools of the University. The Honors Program in Engineering began in September 1960, and has already achieved an important share in the total University effort.

The Program is designed to provide the superior student with greater opportunities and flexibility than possible in the normal curriculum, and to give him a climate for deepened intellectual development. Minimum requirements for freshmen entering the Honors Program in Engineering include admission to the University as a James Scholar. Honors students will be expected to maintain a grade point average of 4.5 (B+).

Students in the Honors Program are assigned to special advisors and encouraged to satisfy course requirements by proficiency examinations or to go directly to advanced courses when advisable. Special sections have been established for them in some courses. For upperclassmen there will be such activities as special projects and seminars.

The Honors Program in the College of Engineering is directed by a faculty committee under the chairmanship of Professor A. I. Ormsbee of the Department of Aeronautical Engineering. Other members of the committee are Professors E. L. Broghamer, E. D. Ebert, C. D. Hendricks, R. E. Miller, D. R. Opperman, D. D. Perlmutter, Mete Sozen, F. V. Tooley, Albert Wattenberg, C. A. Wert, and R. R. Yoerger, representing the various departments in the College.

At a time when our civilization requires the highest possible development of "brainpower," educational institutions have an important obligation to their superior students. In the University of Illinois College of Engineering, this obligation is being met through the Edmund J. James Scholar Program and the College's associated Honors Program.

ENROLLMENT STATISTICS

Final College of Engineering enrollment figures for this semester have been tabulated. By curricula, they are:

AERONAUTICAL ENGINEERING	378
AGRICULTURAL ENGINEERING	74
CERAMIC ENGINEERING	98
CIVIL ENGINEERING	612
ELECTRICAL ENGINEERING	1178
ENGINEERING MECHANICS	60
ENGINEERING PHYSICS	230
GENERAL ENGINEERING	348
INDUSTRIAL ENGINEERING	121
MECHANICAL ENGINEERING	604
METALLURGICAL ENGINEERING	87
MINING ENGINEERING	37
Total	3827

Reflecting the general trend of enrollment increases in the fields of study in science and engineering, the number of beginning freshmen is 15 per cent higher than the number entering at this time last year.

SHORT COURSE ON WELDING ENGINEERING

The first Biennial Short Course on Welding Engineering will be held on the University of Illinois campus December 5-8. The Short Course is being presented through the Division of Engineering Extension. It will be conducted by the Departments of Civil Engineering, Mechanical and Industrial Engineering, and Mining and

Metallurgical Engineering, in cooperation with the American Welding Society.

Besides 12 speakers from the faculties of the departments conducting the Short Course, there will be 15 speakers from industry and research organizations.

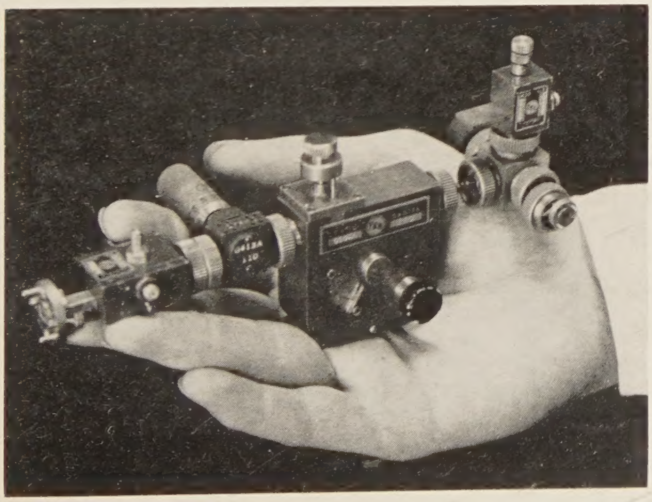
A registration fee of $65 will be charged for the four-day meeting. This fee includes text materials, a copy of the short course proceedings, four scheduled luncheons and a banquet, but not lodging or other meals. Advanced registration is recommended, and this can include reservations for housing during the Short Course.

Additional information and reservation and registration forms may be obtained from the Supervisor of Engineering Extension, 116d Illini Hall, Champaign, Illinois.

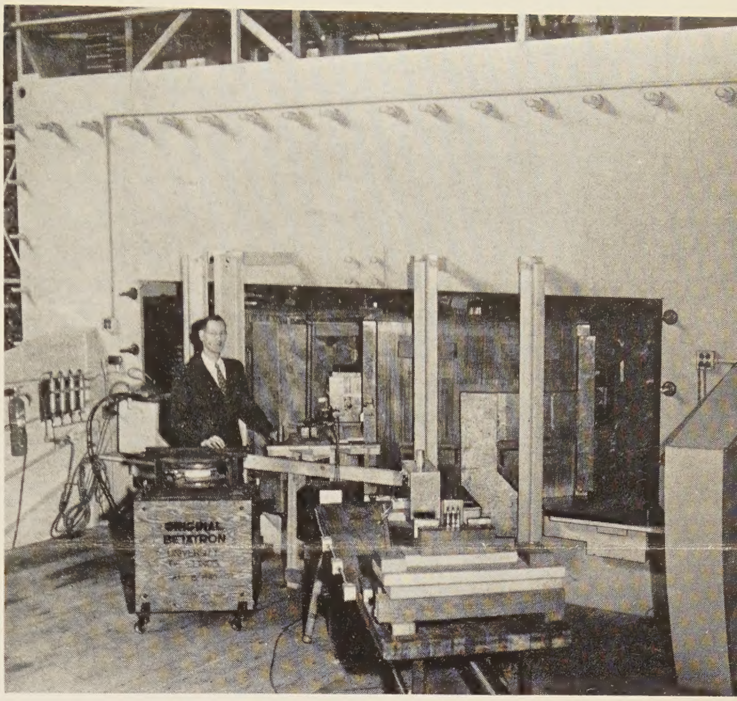
BRIDGING THE MICROWAVE GAP

The detectable waves in the electromagnetic spectrum, in order of increasing frequency (decreasing wavelengths), are radio waves, television signals, microwaves, infrared radiation, visible light, ultraviolet radiation, X-rays, and the family of cosmic rays. Between microwaves and infrared radiation, roughly in the wavelength ranges of 1/10 to 1 millimeter, there is a gap that contains waves which have not been generated in the laboratory. These waves are commonly referred to as ultramicrowaves or submillimeter waves.

The Ultramicrowave Group at the University of Illinois, headed by Dr. Paul D. Coleman, has spent the last ten years trying to bridge this gap by building apparatus to generate, propagate, and receive these high-frequency waves. They have aided in narrowing the gap from its 1950 frontier of 4 millimeters to its present position through the development of a complete set of 2 millimeter components, now produced for the open market by a New York firm. These components, including antennas, waveguides, terminations, tuners, and detectors, are the smallest commercially available microwave components in the world.



A set of 2.14 to 1.36 millimeter wave components using 0.051 x 0.0255 inch ID copper waveguides.



Professor D. W. Kerst stands by two of his creations, the 2.3-million electron volt betatron which is being donated as a permanent display to the Smithsonian Institution and the more recent 340-MEV betatron, which is still a major research tool at the University.

One gets a good idea of the extremely small size of these components from the largest inside dimension of the waveguide cross-section, which is .080 of an inch. A waveguide, as its name suggests, is a hollow rectangular tube which directs the microwave signal to its desired destination. Twenty years ago, 108 mm. waveguides used in some radar systems were considered quite small, but those developed at the University are more than 50 times smaller!

Today it is possible to produce microwaves of 2 mm. wavelength in the laboratory, although not in the quantities of power desired. No reliable way of producing waves in the submillimeter range, 1/10 to 1 mm., has yet been found. Many people feel that electron tubes have reached their practical frequency limit, and that an entirely new set of techniques will be required for further advances.

In fact, the members of the University of Illinois group have given up conventional approaches to wave production and have experimented with optical, solid state, and electron beam interaction techniques. More recently, using megavolt electronics techniques with Cerenkov radiators, they have had promising results which were described in the September 1960 issue of the *Journal of Applied Physics.*

Ultramicrowaves will have many beneficial uses when the problem is finally solved. They are needed to probe the interactions of electrons in plasma jets, primarily because plasmas are opaque for frequencies below the plasma frequency. They will be useful for analyzing the atomic reactions in nuclear reactors; for communications between space vehicles because of their low interference noise characteristics, their high directivity with modest size and power, and their inability to penetrate the atmosphere (which would make such signals undectable from earth) ; and for the study of microorganisms, which change from their ordinary random orientation to an alignment across the lines of force in a microwave field.

Workers in the Ultramicrowave Group are seeking to find an answer to their problem in almost every area of physics and electronics. The gap in the spectrum is being narrowed year by year, but only its final bridging will provide answers to the many speculations about the real nature of ultramicrowaves.

WORLD'S FIRST BETATRON TO SMITHSONIAN

The world's first betatron, an atom-smashing electron accelerator invented at the University of Illinois in 1940 by Professor D. W. Kerst, is being given to the Smithsonian Institution for permanent display.

This first pioneering device which produced 2.3-million electron volts of energy was requested by the Institution for exhibition in the Hall of Electricity of the new U. S. National Museum building in Washington, D. C.

Professor Kerst built three other betatrons which are still in use at the University. A 24-million volt machine, completed in 1941, is the prototype of many now used as X-ray or electron beam sources by medicine and industry. The 80-million volt machine was built in 1948 as a model for the University's 340-million volt betatron, the world's largest, completed in 1950. University of Illinois physicists use the betatrons primarily for research in nuclear physics.

Professor Kerst built his first betatron in the face of failure by others who had tried for years to build a machine which could produce high-energy electrons by means of a magnetic field. It went into operation July 15, 1940. It is about the size of two typewriters side by side, in contrast to multi-million volt conventional X-ray machines, which are as big as automobiles.

The U. of I. 340-million volt betatron became operative February 15, 1950. The science of designing and building betatrons had developed so much during the decade that if the big betatron could be scaled down on a volt for volume basis, 2.3-million volt energy rays would come from a machine the size of a penny matchbox!

Professor Kerst, born in Galena, Illinois, grew up and attended schools in Wauwatosa, Wisconsin, and received bachelor's and doctorate degrees from the University of Wisconsin. He joined the University of Illinois staff in 1938. In 1957 he joined the General Dynamics Corporation as the leader of a $10-million controlled thermonuclear research project.

Among the honors he has received for the invention and development of the betatron are a fellowship in the American Physical Society, membership in the National Academy of Sciences, the Comstock Prize of the National Academy, and the Scott Award of the Franklin Institute.

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